

## CLAIMS

1. An electrolyte for a metal-oxygen battery, said electrolyte comprising:  
a non-aqueous solvent, said solvent being characterized in that the solubility of oxygen therein is at least 0.1150 cc O<sub>2</sub>/cc solvent at STP; and  
a metal electrolyte salt dissolved in said solvent.
2. The electrolyte of claim 1, wherein said solvent comprises a mixture of materials, and wherein at least 50%, on a weight basis, of said materials have an oxygen solubility of at least 0.1760 cc O<sub>2</sub>/cc at STP.
3. The electrolyte of claim 1, wherein said non-aqueous solvent comprises a material selected from the group consisting of: 1,2-dimethoxyethane, tetrahydrofuran, diethyl carbonate, diethyl ether, tetrahydro-2H-pyran, methyl acetate, n-C<sub>8</sub>H<sub>18</sub>, n-C<sub>9</sub>H<sub>20</sub>, n-C<sub>7</sub>H<sub>16</sub>, n-C<sub>7</sub>F<sub>16</sub>, fluorinated organic solvents, and combinations thereof.
4. The electrolyte of claim 1, wherein said metal oxygen battery is a lithium battery, and wherein said metal electrolyte salt is a lithium salt.

5. The electrolyte of claim 4, wherein said lithium salt is selected from the group consisting of  $\text{LiPF}_6$ ,  $\text{LiBF}_4$ ,  $\text{LiClO}_4$ ,  $\text{LiC}(\text{SO}_2\text{CF}_3)_3$ ,  $\text{LiN}(\text{SO}_2\text{CF}_3)_2$ ,  $\text{LiO}_3\text{SCF}_2\text{CF}_3$ ,  $\text{LiO}_3\text{SC}_6\text{F}_5$ ,  $\text{LiO}_2\text{CCF}_3$ ,  $\text{LiP}(\text{C}_6\text{H}_5)_4$ ,  $\text{LiCF}_3\text{SO}_3$ , and combinations thereof.

6. The electrolyte of claim 1, wherein the concentration of said metal electrolyte salt is in the range of 0.5-1.0 molar.

7. A metal-oxygen battery, said battery comprising:

a metal-containing anode;

an electro-active oxygen cathode;

an electrolyte disposed so as to provide for ionic communication between said

5 anode and said cathode, said electrolyte comprising: a non-aqueous solvent, said solvent characterized in that the solubility of oxygen therein is at least 0.1150 cc  $\text{O}_2$ /cc at STP; and

a metal electrolyte salt dissolved in said solvent.

8. The metal-oxygen battery of claim 7 wherein said non-aqueous solvent comprises a plurality of components, and wherein the oxygen solubility of at least 50% of said components, on a weight basis, is at least 0.1760 cc  $\text{O}_2$ /cc at STP.

9. A method for optimizing the composition of an electrolyte for a metal-oxygen battery, said electrolyte comprising a solvent and an electrolyte salt, said method comprising the step of:

selecting said solvent from those materials which will dissolve said electrolyte salt  
5 and which have a solubility for oxygen which is at least 0.1150 cc O<sub>2</sub>/cc at STP.

10. The method of claim 9, wherein said solvent is selected from materials comprising a mixture of components in which at least 50% of said components, on a weight basis, have a solubility for oxygen which is at least 0.1760 cc O<sub>2</sub>/cc at STP.

11. An electrolyte for a lithium-oxygen battery, said electrolyte comprising, on a weight basis: 1 part of a first component selected from the group consisting of propylene carbonate,  $\gamma$ -butyrolactone, and combinations thereof;

at least one part of a second component selected from the group consisting of  
5 diethyl carbonate, 1,2-dimethoxyethane, and combinations thereof; and  
0.5-1.0 moles of a lithium electrolyte salt.

12. The electrolyte of claim 11, wherein said electrolyte salt comprises LiPF<sub>6</sub>.